Do Bank Relationships Affect the Firm's Underwriter Choice in the Corporate-Bond Underwriting Market?

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ABSTRACT

This paper studies the effect of bank relationships on underwriter choice in the U.S. corporate-bond underwriting market following the 1989 commercial-bank entry. I find that bank relationships have positive and significant effects on a firm's underwriter choice, *over and above* their effects on fees. This result is sharply stronger for junk-bond issuers and first-time issuers. I also find that there is a significant fee discount when there are relationships between firms and commercial banks. Finally, I find that serving as arranger of past loan transactions has the strongest effect on underwriter choice, whereas serving merely as participant has no effect.

BEFORE THE HISTORIC WAVE OF DEREGULATION swept the U.S. financial industry in 1989, a small number of top-tier investment banks dominated the underwriting market for corporate securities. Once the wave hit, commercial banks successfully entered the market. In 1989, five commercial banks were granted permission to establish Section 20 subsidiaries to underwrite corporate bonds.[1] Within a few years, commercial banks made substantial inroads into the top echelon of this market. Between 1993 and 1996, the top 10 investment banks' collective market share was 11 percentage points less than it had been between 1985 and 1988 (from 87% to 76%) while the top five commercial banks collectively accounted for 13% of corporate-bond underwriting.

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[1] The name is derived from Section 20 of the Glass-Steagall Act, which prohibits member banks in the Federal Reserve System from affiliating with firms that are engaged "principally" in the securities business. These subsidiaries were permitted to enter the investment-banking business after meeting various requirements, such as a ceiling on their security-related revenues.

Why did these entrant commercial banks succeed in entering this oligopolistic market? Existing literature suggests two sources of explanations. First, many authors discuss bank relationships as a source of informational advantage for commercial banks, arguing that commercial banks have closer, longer-term, and more exclusive relationships with their borrowers than do other types of lenders.[2] These arguments support the view that bank relationships make commercial banks effective providers of underwriting services to firms with which they had relationships and that this could possibly benefit the firms (e.g., through better yields arising through certification). Second, recent papers that examine commercial-bank entry into the underwriting market post-1990 find that underwriting fees have declined with bank entry (Gande, Puri, and Saunders (1999)).

These studies raise the following questions: Is the increased share of bank underwriting (or the source of the advantages of choosing a lending bank as underwriter) coming from discounted underwriting fees? Or are lending relationships important in affecting the firm's choice of underwriters *over and above* any discounted fee effect? Does it matter how strong the lending relationship is, or is the informational advantage shared by all banks with past transactions? This paper investigates these questions and provides some new empirical evidence.

Effects of commercial-bank underwriting on bond performance and underwriting fees have been extensively studied in the literature. Many of these studies examine the question of whether commercial banks' conflict of interest offsets their certification ability.[3] For example, Puri (1996) and Gande et al. (1997) (focusing on the pre-Glass-Steagall period and the modern period, respectively) examine *ex ante* yields of bonds and find that issues underwritten by commercial banks performed better than or as well as those underwritten by investment houses, which is consistent with net certification.[4] On the question of the effect of commercial-bank underwriting on fees, Gande et al. (1999) find that firms underwritten by commercial banks paid roughly the same fees as those underwritten by investment banks in the pre-1997 period. In contrast,

[2] Leland and Pyle (1977), Diamond (1984), and Fama (1985), among others, argue that banks have scale economies and comparative cost advantages over other lenders (including individual bondholders) in producing information about the borrowers. Others, such as Chemmanur and Fulghieri (1994b), attribute the monitoring ability of banks to their incentive to build their reputation as lenders. James (1987), Lummer and McConnell (1989), and Billett, Flannery, and Garfinkel (1995), among others, provide empirical evidence that new bank loans have different positive announcement effects on borrower firm's stock returns.

[3] Rajan (1998), Puri (1999), and Kanatas and Qi (1998), among others, analyze the implications of commercial-bank underwriting in the presence of conflict of interest.

[4] Ang and Richardson (1994), Kroszner and Rajan (1994), and Puri (1994) investigate the same question using *ex post* default performance of pre-Glass-Steagall-era bonds and obtain similar results. Konishi (2002) studies both default rates and the *ex ante* yield using prewar data in Japan. Ber, Yafeh, and Yosha (2001) and Hamao and Hoshi (2003) examine a similar but slightly different question of the costs and benefits of universal banking in Israeli IPO and Japanese bond markets, respectively, and find more mixed evidence in their international data.

Roten and Mullineaux (2002) find that commercial banks charged lower fees than investment banks over the period 1995–1998.[5]

The approach taken in this paper differs from the previous studies in that I directly model the firm's underwriter-choice problem and measure the effect of relationships on the choice of underwriter. This is in contrast to the previous works that deal largely with equilibrium pricing outcomes. To isolate the relationship effect, I use a multinomial-choice setup in which a firm chooses one bank out of multiple choices. Further, I use a framework that permits imputation of unobserved fees conditional on the choice of underwriter. One advantage of the econometric approach taken in this paper is that it allows for full variation across banks in terms of the relationships they have with individual firms, both when they are chosen (and we observe the underwriting fees) and when they are not (and we do not observe the underwriting fees). This method of analyzing imperfect market competition has become a standard tool in the industrial organization literature[6]; however, to the best of my knowledge, it has not been used before in the finance literature.[7]

In particular, the goal of this paper in using such a methodological framework is to answer the following questions:

1. Are underwriting fees important for the firm's decision in whether to choose its lending bank as its underwriter? If so, do lending banks that also underwrite charge lower fees? These inferences are drawn from the fee coefficient in the underwriter-choice model and the relationship coefficient in the fee equation, respectively.
2. Do underwriting-fee discounts explain why firms pick their lenders as underwriters or are the lending relationships an important determinant of the firm's choice of underwriters *over and above* the underwriting fees? This inference is drawn from the relationship coefficient in the underwriter-choice model.
3. How does the importance of the lending relationships and underwriting-fee discounts vary for more information-sensitive securities such as junk bonds (as opposed to investment-grade issues) or new issues (as opposed to seasoned issues)? This inference is also drawn from the estimates of the underwriter-choice model.
4. Does the strength of the relationship (e.g., whether the lending bank is a lead arranger or simply a participant in the loan) matter? This inference is drawn by using alternative measures of relationships in the model.

[5] In a related paper, Drucker and Puri (2005) also find that when an issuing firm receives lending from an underwriter around the time of the issue, it receives lower underwriter fees on seasoned equity offerings.

[6] Bresnahan (1989) provides an excellent survey of this literature.

[7] More recently, a related approach is also taken by Ljungqvist, Marston, and Wilhelm (2005) in their study of the effect of analyst behavior on underwriter choice in both equity and debt markets. They find that investment-banking relationships are quite significant in determining underwriter choice.

In order to conduct this study, I constructed a unique data set consisting of 1,535 U.S. domestic corporate-bond issues for the period 1993 to 1997. This data set combines individual issue-level and firm-level data with firm-specific and bank-specific data on previous loan arrangements. Bank-relationship data are constructed from the Loanware database, which is compiled by Capital Data (a division of Dealogic) and consists of individual loans as well as syndicated loans. Special care is taken to account for the significance of roles played by banks in these loans as well as to sort out the effect of bank mergers on bank affiliations in the database.

The findings indicate that bank relationships are very important in shaping bank competition in the bond underwriting market. First, I find that bank relationships have positive and significant effects on underwriter choice, over and above their effects on underwriting fees. This result is sharply stronger for junk-bond issuers and first-time issuers. I draw inferences here from the estimates of the underwriter-choice model. The competitive effect of commercial-bank entry is the greatest for segments of issuers with high informational sensitivity (such as junk-bond issuers), where these relationships are more likely to be present and also where these relationships are valued more by the issuers.

Second, I find that there is a significant fee discount when there are relationships between the firms and commercial banks. This inference is drawn from the fee estimates of the model. My result indicates that commercial banks charge lower fees to those firms with which they have relationships than to other firms. One possible explanation is that their marginal information costs are lower for serving their lending clients and they are sharing part of the cost savings with them. Given that commercial banks obtain better yields for these firms (as earlier studies found), it is plausible that commercial banks would charge higher fees in equilibrium to extract away this yield benefit from the firm. The fact that we observe a relationship discount rather than a premium is therefore an interesting finding and suggests that commercial banks are not at an absolute competitive advantage over investment banks in this market.[8]

Third, I find that the strength of the relationship between the bank and the firm matters. Specifically, merely serving as a participant in a past loan transaction does not affect a bank's chance of being chosen as an underwriter in the future. In contrast, serving as an arranger of a past loan transaction has the strongest effect on a bank's likelihood of being chosen as the underwriter.[9] In terms of the economic roles of loan syndicates, this finding supports the view that only top-tier members of syndicates are engaged in information production about the borrower firms, while lower-tier members are merely invited by arranger banks for risk-sharing purposes and do not gain any informational advantage about the firms.

The remainder of the paper is organized as follows. Section I describes the bond underwriting market and the research hypotheses to be tested. Section II

[8] Fang (2005) empirically examines the cost and benefit of hiring a bank with a high reputation and finds that top-tier investment banks indeed obtain better yields and charge higher fees.

[9] Similar results are reported for the post-deregulation Japanese bond market in Yasuda (2004).

describes the data. Section III specifies the empirical model. Section IV presents and discusses the estimation results. Section V concludes.

I. The Market for Underwriting Services

When a firm decides to issue a bond, it hires an underwriting bank, which, for a fee, provides two kinds of services: (1) insurance for unsold securities and (2) assistance in documenting, marketing, pricing, and selling the security. The fee variation across transactions is easily observed, and it is strikingly high in the bond market, especially compared to the often-quoted "7% fix" in the equity IPO market.[10] What accounts for these variations in fees? From the bank's perspective, the cost of underwriting is likely to be associated with some features of the bonds, such as the maturities and the shelf-registration status. Long-maturity bonds are less liquid and their prices are more volatile; therefore, fees are expected to be higher the longer the maturity of the bond. Shelf registration (e.g., medium-term notes programs), on the other hand, simplifies the issuance procedures and allows for flexible timing of issuance. Thus, it is expected to lower the fee.

The costs of underwriting services are also associated with some characteristics of the issuers. For example, if the issuer is a "hot," well-regarded name in the market, the cost of marketing and selling the security is low. In contrast, it is more expensive to market and distribute a less well-known issuer's bond. Investors need to be educated and persuaded harder to purchase the bond (even after controlling for its higher yield), which also requires educating the bank's sales force. Thus, the information-sensitivity characteristics of the issuing firms and bonds are factored into the price of underwriting services. Credit ratings and previous issue experience of the firms are examples of such characteristics.

Banks incur costs in assessing the issuer's creditworthiness and certifying the information to the investors, that is, in information production. Established networks and communication channels with an issuer increase a bank's effectiveness in producing information about that particular issuer. With this informational advantage, banks with prior relationships can build up demand for the securities faster and face a lower risk of unsold securities and a lower marginal cost of marketing and sales. Since they face lower cost functions *even after controlling for the issuer and bond characteristics*, banks may charge lower fees to firms with which they have had relationships than to those they have not. In particular, entrant commercial banks may strategically set their fees equal to their marginal cost while trying to build market share in the underwriting market. On the other hand, since these banks may be able to fetch better yields for the firms, they might charge higher fees to extract part of the yield benefit from them.

Issuing firms may prefer banks that are more effective at producing information. The higher credibility of the information they produce leads to lower

[10] Chen and Ritter (2000) and Hansen (2001), among others, examine this issue in the equity IPO market.

adverse selection and, hence, a lower yield (a higher bond price). So the underwriting service is expected to be differentiated mainly along two dimensions—fees and effective information production, which is measured by bank relationships.

The effect of bank relationships on underwriter demand (over and above their effects on fees) depends on the firm's valuation of the relationships. What kinds of firms would value bank relationships with underwriters? Diamond (1991) uses the borrowing firm's reputation to explain its choice between bank loans and bonds. The main result of the paper is that borrower reputation and the need for bank monitoring are inversely related. Young firms and old firms with low borrower reputations do not have reputations to lose and bank monitoring is needed to enforce efficient investment decisions; as a result, they tend to rely more on bank loans. Large established firms with high borrower reputations, on the other hand, do have a valuable reputation to lose and therefore have sufficient incentives to choose efficient investment decisions; since bank monitoring is costly, this class of firms prefers to issue bonds. Thus, borrower reputation is a cumulative product of the firm's financing history and is inversely related to the informational sensitivity of issuers.

This argument (referred to as Diamond's reputation-building argument in the rest of the paper) predicts that the issuing firm's valuation of bank relationships is inversely (positively) related to its borrower reputation (informational sensitivity): firms with low borrower reputation (high informational sensitivity) are expected to value them the most, since they stand to gain the most from choosing an underwriting bank with certification ability. For firms with high borrower reputation (low informational sensitivity), on the other hand, the information-production effectiveness of banks is largely redundant, since their securities can sell easily in the market regardless of who the underwriter is.

Finally, the effect of bank relationships on underwriter demand is expected to depend on the strength of bank relationships. Banks that made significant efforts in gathering information about the firm in past loan transactions may be more effective in certifying them as underwriters than those banks that just passively participated in the loan syndicates. On the other hand, the information may be equally shared among all participating banks. I will test this question by examining the various roles that banks have played in loan transactions.[11]

To summarize, I investigate the following questions in this paper:

1. How do bank relationships affect underwriting fees?
2. Are bank relationships significant in determining the firm's underwriter choice?
3. Does the effect of relationships on underwriter choice depend on the informational sensitivity of the firms?
4. Does the effect of relationships on underwriter choice depend on the strength of the relationships?

[11] I am grateful to an anonymous referee for suggesting this fruitful direction of research.

II. The Data

A. Data Sources

I construct the data set using two data sources. One is U.S. Domestic New Issues Database by the Thomson Financial Securities Data, which compiles new-issues information from company filings, press releases, and news sources. The other is Loanware Database compiled by Capital Data (a division of Dealogic), a joint venture between Computasoft, Ltd. and Euromoney Institutional Investor Plc. This database contains detailed historical information on global syndicated loans and related instruments, and I use its U.S. national market segment.[12] DealScan, which is compiled by Loan Pricing Corporation, is another database that collects similar loan transaction information. Both Loanware and DealScan are purchased by large investment banks and institutional investors, and the two databases appear to offer equivalent coverage in the U.S. market.[13]

In constructing relationship variables from the Loanware database, I paid careful attention to past mergers and acquisitions by lending banks and borrowing firms. Using CUSIPS and name matches I determined those transactions where firms' names have changed between the time of the loan transaction and the time of the bond issuance. Banks' transactions were similarly determined.

B. Data Selection

I chose the sample period from January 1, 1993 to August 31, 1997, a duration of 4 years and 8 months, based on the following criteria. First, the sample begins after January 1989, when the first commercial-bank underwriting of a public corporate bond took place. Second, during this period, the economic and regulatory environment surrounding the underwriters and issuers remained relatively stable. Third, the sample ends in August 1997, primarily due to the merger in September 1997 of Salomon Brothers and Smith Barney (as a result of the acquisition of Salomon by Travelers, Smith Barney's parent company); this event represented the first merger of two existing major players in the

[12] See Kleimeier and Megginson (2000), Esty and Megginson (2003), and Smith (2003) for examples of Loanware usage in the literature.

[13] To verify how the two databases compare, I contacted sales representatives of both database companies. According to them, both firms compile their databases from the same sources: data submissions by banks themselves and SEC filings by borrower companies. (Banks have incentives to self-report on their transactions so that their deals are included in the league-table calculations.) So their data-collection methodology is equivalent. To compare their coverage of the U.S. domestic market, I obtained the top 10 lead arrangers in the U.S. market league tables for the latest available period from their websites. Comparing the two tables reveals that, for 5 out of 10 banks, Loanware covered more deals than DealScan and that, for 4 out of 10, DealScan covered more deals than Loanware. For one bank in the top 10, the two databases contained the same number of deals. The overall volumes covered were $689 billion and $639 billion for Loanware and DealScan, respectively. While neither database is perfect (since each apparently misses some transactions that the other collects), there seems to be no systematic difference between the two databases in terms of their U.S. market coverage.

U.S. corporate-bond underwriting market, thus affecting the overall market structure.

Consistent with prior studies, I exclude financial firms (one-digit SIC code 6) and regulated industries (one-digit SIC code 4) from the sample. I also concentrate on the top 16 underwriters of fixed-rate, nonconvertible corporate debt.[14] Fixed-rate debt comprises about 90% of all nonconvertible issues, and both the composition and the sum of market shares of top underwriters are virtually uniform between fixed-rate and other coupon-type bonds. For my sample, 5 of the 16 underwriters are Section 20 subsidiaries of bank holding companies, namely J. P. Morgan, Chase Manhattan Bank, Bankers Trust, Citicorp, and Nations Bank. Using the above criteria, I obtain a sample of 1,535 fixed-rate, nonconvertible corporate-bond issues.

C. Descriptive Statistics of the Sample

Table I reports various sample summary statistics from which several observations can be made. First, issues underwritten by commercial banks are smaller than issues underwritten by investment banks. Their maturity also tends to be slightly shorter, but no better or worse in terms of credit ratings. There are a few plausible reasons for this. For example, if a smaller, younger firm is more likely to choose the commercial bank with which it had built close ties, the issue size might proxy for characteristics of that firm. Or, if commercial banks have a smaller distribution capability relative to investment banks, the issue size might reflect the supply-side constraint.

Panels D and E of Table I report the sample tabulated by previous issue experience and by the issuer's SIC code. Commercial-bank issues are relatively more frequent among first-time issuers. This observation is consistent with the proxy explanation just discussed. In contrast, there is little difference between commercial-bank and investment-bank subsamples in terms of the distribution of issuers across different industries.

III. Empirical Methods

A. Demand Model

Previous studies on underwriter choice typically use a dichotomous probit specification, where the dependent variable equals 1 if a firm uses a commercial-bank underwriter and 0 if it uses an investment-bank underwriter. In this setup, all commercial banks are treated as homogeneous. Since firms have relationships with some banks and not with others, this approach cannot measure the effect of relationships on underwriter choice. To isolate the relationship effect, we need a multinomial-choice setup where a firm chooses one bank out of multiple choices. This allows full variation across banks in terms of the

[14] The rankings were based on the dollar value of underwritings and gave full credit to the book-runner(s).

Table I

Sample Summary Statistics

This table presents sample summary statistics for the 1,535 bond issues underwritten in the 1/1993–8/1997 period. Issue size is the amount of principal reported in the SDC New Issues Database. Lead underwriter is given full credit for the deal. Market shares are computed by dividing the subcategory's total number of issues by the category total. Credit rating refers to the issue's Moody's rating. Commercial-bank issues are issues lead-underwritten by Section 20 subsidiaries of commercial banks. First-time issue refer to the firms with no previous issues of nonconvertible bonds. SIC code is the issuer's primary SIC code reported in the SDC New Issues Database.

Panel A: By Issue Size ($millions)

	<= 75	75 < <= 150	150 <	Total
All issues				
No. of issues	216	687	632	1,535
Market shares (by no. of issues)	0.14	0.45	0.41	1.00
Transaction volume ($millions)	$7,209.5	$82,769.8	$189,541.8	$279,521.1
Commercial bank issues				
No. of issues	54	115	54	223
Market shares (by no. of issues)	0.24	0.52	0.24	1.00
Transaction volume ($millions)	$1,242.0	$13,804.0	$14,146.0	$29,192.0
Investment bank issues				
No. of issues	162	572	578	1,312
Market shares (by no. of issues)	0.12	0.44	0.44	1.00
Transaction volume ($millions)	$5,967.5	$68,965.8	$175,395.8	$250,329.1

Panel B: By Maturity (years)

	<= 5	5 < <= 15	15 <	Total
All issues				
No. of issues	240	962	333	1,535
Market shares (by no. of issues)	0.15	0.63	0.22	1.00
Transaction volume ($millions)	$32,885.7	$177,556.3	$69,079.1	$279,521.1
Commercial bank issues				
No. of issues	44	154	25	223
Market shares (by no. of issues)	0.20	0.69	0.11	1.00
Transaction volume ($millions)	$3,490.0	$22,094.5	$3,607.5	$29,192.0
Investment bank issues				
No. of issues	196	808	308	1,312
Market shares (by no. of issues)	0.15	0.62	0.23	1.00
Transaction volume ($millions)	$29,395.7	$155,461.8	$65,471.6	$250,329.1

Panel C: By Credit Rating

	Caa-Ba	Baa-Aaa	Total
All issues			
No. of issues	469	1,066	1,535
Market shares (by no. of issues)	0.31	0.69	1.00
Transaction volume ($millions)	$87,796.6	$191,724.5	$279,521.1
Commercial bank issues			
No. of issues	73	150	223
Market shares (by no. of issues)	0.33	0.67	1.00
Transaction volume ($millions)	$11,810.0	$17,382.0	$29,192.0
Investment bank issues			
No. of issues	396	916	1,312
Market shares (by no. of issues)	0.30	0.70	1.00
Transaction volume ($millions)	$75,986.6	$174,342.5	$250,329.1

(*continued*)

Table I—*Continued*

Panel D: By Previous Issue Experience			
	First-Time	Seasoned	Total
All issues			
No. of issues	678	857	1,535
Market shares (by no. of issues)	0.44	0.56	1.00
Transaction volume ($millions)	$123,955.9	$155,565.2	$279,521.1
Commercial bank issues			
No. of issues	117	106	223
Market shares (by no. of issues)	0.52	0.48	1.00
Transaction volume ($millions)	$16,447.0	$12,745.0	$29,192.0
Investment bank issues			
No. of issues	561	751	1,312
Market shares (by no. of issues)	0.43	0.57	1.00
Transaction volume ($millions)	$107,508.9	$142,820.2	$250,329.1

Panel E: By SIC Codes				
	000's	1000's	2000's	3000's
All issues				
No. of issues	9	193	468	334
Market shares (by no. of issues)	0.01	0.13	0.30	0.22
Transaction volume ($millions)	$1,635.0	$31,970.6	$88,846.6	$69,470.8
Commercial bank issues				
No. of issues	1	30	61	59
Market shares (by no. of issues)	0.004	0.135	0.274	0.265
Transaction volume ($millions)	$300.0	$4,015.0	$8,270.0	$7,006.0
Investment bank issues				
No. of issues	8	163	407	275
Market shares (by no. of issues)	0.006	0.124	0.310	0.210
Transaction volume ($millions)	$1,335.0	$27,955.6	$80,576.6	$62,464.8
	5000's	7000's	8000's	Total
All issues				
No. of issues	233	233	65	1,535
Market shares (by no. of issues)	0.15	0.15	0.04	1.00
Transaction volume ($millions)	$39,548.5	$35,849.6	$12,200.0	$279,521.1
Commercial bank issues				
No. of issues	34	31	7	223
Market shares (by no. of issues)	0.152	0.139	0.031	1.000
Transaction volume ($millions)	$5,375.0	$3,421.0	$805.0	$29,192.0
Investment bank issues				
No. of issues	199	202	58	1,312
Market shares (by no. of issues)	0.152	0.154	0.044	1.000
Transaction volume ($millions)	$34,173.5	$32,428.6	$11,395.0	$250,329.1

relationships they have with individual firms, both when they are chosen and when they are not.

In this paper, I use the nested multinomial logit model, which is a generalization of the multinomial logit model (also called conditional logit model), both developed by McFadden (1974, 1978, 1981).[15] The nested logit model relaxes

[15] The models are also discussed in Maddala (1983); see p. 41 and p. 67.

the irrelevance of independent alternatives (IIA) property of the logit model by structuring the decision process as a tree or nest structure. The IIA assumption implies that odds ratios in the multinomial logit models are independent of the other choices, which is inappropriate in many instances.[16] The nested multinomial logit model is used by Goldberg (1995) in her study of the effect of tariffs on automobile demand and by MacKie-Mason (1990) in his study of the firm's choice of external financing.

Formally, the model consists of a maximization problem for a firm i choosing over banks $1, \ldots, 16$ (where banks are indexed by j). I define

$V^*_{i,j}$ = the level of latent value for firm i choosing bank j,
$V_{i,j} = 1$ if firm i chooses bank j,
$V_{i,j} = 0$ otherwise.

I further specify the latent underwriter-choice equation as follows:

$$\begin{aligned} V^*_{i,j} &= \alpha FEE_{i,j} + \beta LOAN_{i,j} + \delta_j^{LMAT} ln\,(MATURITY)_i \\ &\quad + \delta_j^{ISSUE}\, ln\,(NO.ISSUES + 1)_i + \delta_j^{MTN}\, MTN_i + \delta_j^{LAMT}\, ln\,(AMOUNT)_i \\ &\quad + \delta_j^{INVG} INVGRADE_i + \delta_j^{YEAR}\, YEARS_i + \delta_j^{SIC}\, SIC_i + \epsilon_{i,j}. \end{aligned} \tag{1}$$

$FEE_{i,j}$ is the underwriting fee charged by bank j. The fee definition used in the estimation is a gross spread, which is the fee that underwriters receive as a percentage of the issue proceeds. A typical public bond offering consists of multiple underwriters forming a selling syndicate, where one underwriter serves as the book-runner. Consistent with prior studies, I identified the book-runner (or the lead-manager) as the underwriter of a given issue.[17]

The relationship variables $LOAN_{i,j}$ (for $j = 1, \ldots, 16$ for 16 underwriting banks in the sample) are constructed using transactions data from the Loanware database. A loan agreement frequently (but not always) consists of participation by a number of banks. The bank-relationship definition used in the baseline model is whether or not a given bank has acted as an arranger for a given firm in a loan transaction. In other words, the dummy variable $LOAN_{i,j}$ for bank j is 1 if it has served as an arranger for firm i between 1980 and 1992, and 0 if not. This way, the variable picks up only the core bank in a syndicated loan deal, whereas it still correctly identifies the lending bank in a solo deal. These variables capture the presence of loan relationships between a given firm and individual banks that existed before the banks entered into the underwriting market. I treat these relationships as predetermined and exogenous to the competition in the underwriting market.

On some occasions, investment banks also act as arrangers of syndicated loans. This variable needs to be interpreted differently from an arrangership of syndicated loans by commercial banks because investment banks do not participate in the syndicate as creditors, whereas a commercial-bank arranger

[16] Maddala (1983) discusses this issue with the famous "red bus, blue bus" example in p. 62. Also, see Greene (1993), p. 671.

[17] In a small number of cases where there were two co-book-runners, each was counted as if it underwrote separate issues.

is usually the top lender in the syndicate as well. My interpretation is that this variable for investment banks is an indirect measure of their closeness to the issuer through their investment-banking activities, of which loan syndication is a relatively small but recently growing part. Alternatively, it is also plausible that they are being chosen as arrangers only because they know other banks well and not because they are committed to knowing the borrowing firm. If that is the case, the *LOAN* variable for investment banks should not be significant in determining the firm's underwriter choice. To examine this question, I estimate *LOAN* coefficients separately for commercial banks and investment banks.

I also investigate certain characteristics of issuers and bonds, as the summary statistics indicate that these characteristics may be associated with a greater likelihood of underwriting by commercial banks than others. The value $ln\,(MATURITY)_i$ is the natural log of the bond maturity in years. The value $ln\,(NO.\ ISSUES + 1)_i$ is the natural log of the number of previous bond issues plus 1. The value MTN_i is 1 if the bond is issued under shelf registration or the MTN program, and 0 otherwise. This is an indicator of issue frequency. Registering for this program simplifies the filing process and reduces the legal and accounting costs of incremental issues. The value $ln\,(AMOUNT)_i$ is the natural log of the issue size in \$millions. The value $INVGRADE_i$ is 1 if the issue is rated by Moody's as investment grade, and 0 otherwise. The variable $YEARS_i$ represents year dummies ($YEAR94 = 1$ if the issue date is in 1994, etc.). The variable SIC_i represents SIC code dummies to control for industries ($SIC2 = 1$ if the issuer's primary SIC code is in the 2000s, etc.). Finally, $\epsilon_{i,j}$ is the error term, which captures the effects of agent idiosyncrasies, imperfections in maximization, and other random aspects of the firm's choice problem. Note that $FEE_{i,j}$ and $LOAN_{i,j}$ vary across both bond issues ($i = 1, \ldots, N$) and banks ($j = 1, \ldots, 16$), whereas other explanatory variables, such as $ln\,(MATURITY)_i$, vary only across issues.

Specifying the generalized extreme-value (GEV) distribution for the error term and the nest structure as given in Figure 1 yields the nested multinomial logit model. At the lower level of the nest are 16 alternative underwriting banks, indexed by j, and at the upper level of the nest are two alternatives, commercial banks and investment banks, indexed by m.

Given this nest structure, we can write

$$\Pr(j) = \Pr(j \mid m) \cdot \Pr(m). \tag{2}$$

The choice probability for each of the 16 alternatives at the lower level of the nest (conditional on the upper-level choice) is

$$\Pr(j \mid m,\, i) = \frac{e^{\alpha FEE_{i,j} + \beta LOAN_{i,j}}}{\sum_{k=1}^{K_m} e^{\alpha FEE_{i,k} + \beta LOAN_{i,k}}}. \tag{3}$$

The choice probability for each of the two alternatives (commercial banks and investment banks) at the upper level of the nest is

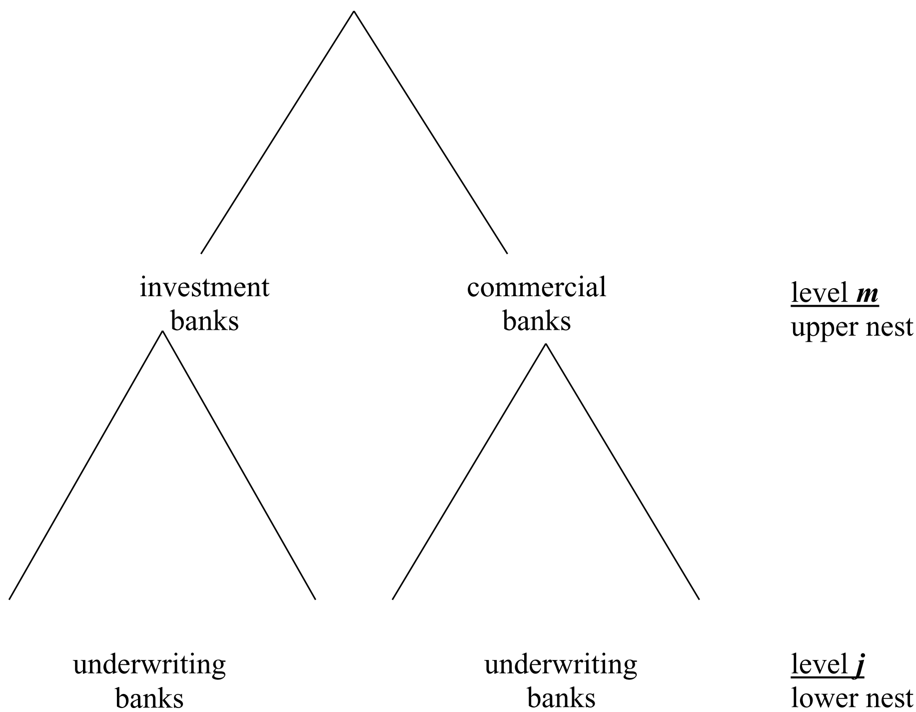

Figure 1. Firm's choice set. This figure specifies the nest structure used in the demand model.

$$\Pr(m, i) = \frac{e^{w_i^\top \delta_m + \lambda I_{i,m}}}{\sum_{t=1}^{2} e^{w_i^\top \delta_t + \lambda I_{i,t}}}, \tag{4}$$

where

$$I_{i,t} = \log\left(\sum_{l=1}^{L_t} e^{\alpha FEE_{i,l} + \beta LOAN_{i,l}}\right), \tag{5}$$

and where $w^\top \delta$ refers to the bond and issuer characteristics $ln\,(MATURITY)_i, \ldots, SIC_i$ and their corresponding coefficients $\delta^{LMAT}, \ldots, \delta^{SIC}$. Since these are chooser-specific (and not choice-specific) variables, parameters are estimated separately for each choice (thus δ are now subscripted by m). The inclusive value $I_{i,t}$ measures the expected aggregate value of subset t, and the coefficient λ reflects the dissimilarity of alternatives within a subset. Thus, $\lambda = 1$ implies that there are no differences in substitution patterns between choices within the nests and those across the nests, whereas $\lambda = 0$ implies that there is perfect correlation among choices within the nests. Allowing λ to be other than 1 makes this model more general than the multinomial logit model.

More importantly, this allows us to test whether there are any differences between commercial banks and investment banks that are inherently specific to their organizational forms after explicitly controlling for bank relationships. This coefficient essentially indicates whether there are systematic differences between commercial banks and investment banks that are not captured by other control variables.

In addition to estimating this baseline model, I am also interested in examining how the firm's valuation of relationships varies with its informational sensitivity. As discussed earlier, Diamond's reputation-building argument predicts a positive relationship. To test this hypothesis, I also estimate specifications where the informational-sensitivity characteristics of issuers interact with the relationship and fee variables.[18] Specifically, I estimate separate *LOAN* and *FEE* coefficients for junk-bond issuers and non-junk-bond issuers in one specification (junk vs. non-junk model), along with separate *LOAN* and *FEE* coefficients for first-time issuers and seasoned issuers in another (first-time vs. seasoned model).

B. Fee Equations

A data issue arises in studying this market because fees vary across both issuers and banks, but only one fee per issue is observed, namely, the fee offered by the bank that is hired to underwrite the bond. Thus, I impute the fees of unchosen banks for each issue. This follows the practice of competition studies of other industries. I control for the correlation of fees with the quality of the issue by using the same issue category as the one realized in each observation. For example, if a given observation was a short-maturity, investment-grade, first-time issue without medium-term notes (MTN) registration, I impute the fees for that issue category for all banks.

Specifically, I impute the fees in the following multivariate specification:

$$\begin{aligned} FEE_{i,j} = {} & \gamma_j^{CONS} + \gamma_j^{LMAT}\, ln\,(MATURITY)_i + \gamma_j^{ISSUE}\, ln\,(NO.ISSUES + 1)_i \\ & + \gamma_j^{MTN}\, MTN_i + \gamma_j^{LAMT}\, ln\,(AMOUNT)_i + \gamma_j^{CREDIT}\, CREDIT\ RATINGS_i \\ & + \gamma_j^{YEAR}\, YEARS_i + \gamma_j^{SIC}\, SIC_i + \gamma_j^{LOAN}\, LOAN_{i,j} + u_{i,j}. \qquad (6) \end{aligned}$$

As discussed in Section I, underwriting fees are determined by the costs of distribution, of taking market risk and reputation risk, and of information production. The value γ_j^{CONS} is the constant coefficient. The value $ln\,(MATURITY)_i$ is the natural log of the bond maturity in years. In general, underwriters demand higher underwriting fees for longer maturity bonds. This makes sense to the extent that a normal yield curve is also upward-sloping; in addition,

[18] This further relaxes the restrictive nature of traditional discrete-choice models by allowing differences between individual choosers (firms) to have a systematic effect on their valuations. This point is well discussed in Goldberg (1995).

the secondary market for 30-year corporate bonds is much less liquid than for 30-year treasury bonds.

The value $ln\,(NO.ISSUES + 1)_i$ is the natural log of the number of previous bond issues plus 1. From the underwriter's point of view, the bonds of seasoned and frequent issuers are easier to market than those of first-time or infrequent issuers, and they are less likely to lead to failed transactions because the frequent issuers' track records decrease their informational sensitivity. Thus, the fee is expected to be decreasing in this variable.

The value MTN_i is 1 if the bond is issued under shelf registration or the MTN program, and 0 otherwise. This is an indicator of issue frequency. Registering for this program simplifies the filing process and reduces the legal and accounting costs of incremental issues.

The variable $ln\,(AMOUNT)_i$ is the natural log of the issue size in $millions. A larger issue is more liquid than a smaller issue, ceteris paribus, and thus underwriters may charge lower fees (as a percentage of total proceeds) for it. For large, so-called "bulge-bracket"[19] investment banks with high fixed overhead costs, underwriting larger issues is more cost-effective, so they may strategically give a size discount. For smaller investment banks and commercial banks, distributing large issues is less cost-effective, so they are expected not to give as steep size discounts as large investment banks.

The variable $CREDIT\,RATINGS_i$ represents credit rating dummies corresponding to the issue's Moody's rating. For example, Aa dummy $= 1$ if the issue's rating is Aa, and 0 otherwise. Having lower credit ratings means issuers have less financial strength and, in general, face higher informational sensitivity than those with higher credit ratings. This increases the risk-related cost for the underwriter. It might also mean that it is more costly to distribute these bonds, since the company is less well-known and investors need to be marketed more intensively. For similar reasons, investors require substantially higher yields for junk bonds. The variable $YEARS_i$ represents year dummies ($YEAR94 = 1$ if the issue date is in 1994, etc.). The variable SIC_i represents SIC dummies as defined before.

An explanatory variable of particular interest is bank relationships. The value $LOAN_{i,j}$ is 1 if a prior loan relationship exists, and 0 otherwise. I use the same relationship definition here as in the demand model. Banks may systematically raise or lower the fees they charge to firms with which they have relationships. For example, banks may lower fees for firms with which they have relationships because their marginal information costs are lower. As a result, ceteris paribus, those firms would be more likely to choose that bank (assuming a downward-sloping demand for underwriting service). On the other hand, banks may charge higher fees to extract part of the yield benefit from the firms. Then these firms with relationships would be less likely to choose the bank. In either direction, relationships can affect the firm's underwriter choice

[19] "Bulge-bracket" is Wall Street jargon for the most elite investment banks. It literally refers to the banks in an underwriting syndicate that were responsible for placing the largest amounts of the issue with investors and whose names appear first in the tombstone.

indirectly through their effects on fees. By including relationship variables in the fee equations, we isolate the effect of relationships on underwriter choice (in the demand model) over and above their effects on fees. Finally, $u_{i,j}$ is the error term, which is assumed to be distributed i.i.d. $N(0, \sigma^2)$.

Note that, though the fees are assumed to be exogenous in the model, the observations I use to compute the average fees are not a random subset, but are the fees charged when they are chosen. Not controlling for this feature of the data will lead to biased estimates of fees. To illustrate this point, let c_i represent the index of the bank chosen by firm i. Since the fee affects the demand for a given bank's underwriting service negatively (assuming a downward-sloping demand), the fact that a given bank was chosen over other banks in the choice set implies that these observed fees, $(FEE_{i,j}; j = c_i)$, are on average *lower* than the unconditional distribution of $FEE_{i,j}$. As a result, if I impute unobserved fees by obtaining estimates of γ from equation (6) using observed fees as dependent variables, the model will systematically underestimate unobserved fees and bias the fee coefficient α toward 0.

To control for this feature of the data, I use the expectation–maximization (EM) algorithm to impute the fees conditional on the firm's underwriter choice.[20] The main idea is to obtain fee-equation estimates γ and demand-equation estimates α and β jointly in an iterative algorithm where fee imputation is conditional on the information in $c_i, i = 1, \ldots, N$ and where maximum likelihood estimation is straightforward. The demand estimates obtained from this estimation method are then used to estimate the upper level of the nested logit model. Details of the procedures are described in the Appendix.

C. Research Hypotheses

With the empirical model specified, I test the following research hypotheses:

1. How do relationships affect fees? This is captured by the coefficient γ^{LOAN} in equation (6).
2. Are fees and relationships significant in determining the firm's underwriter choice? These effects are captured by the coefficients α and β, respectively, in equation (3).
3. Does the effect of relationships on underwriter choice depend on the informational sensitivity of the firms? This is tested by allowing the valuations of relationships and fees to vary across these sensitivity characteristics (such as issuers' credit ratings and previous issue experience).
4. Does the effect of relationships on underwriter choice depend on the strength of the relationships? This is tested by broadening the definition of bank relationships and examining how the coefficient β in equation (3) changes.

[20] See Dempster, Laird, and Rubin (1977) and McLachlan and Krishnan (1997) for the literature survey of this method.

IV. Estimation Results

A. Baseline Model

Table II reports the EM algorithm estimation results of the baseline underwriter-choice model. Panel A presents estimates of the fee equations, γ; Panel B presents estimates of the demand model, α, β, λ, and δ. In Panel A, commercial banks and investment banks are aggregated separately.[21] Overall, the coefficients are consistent with the analysis of fee determination in Section I and with the discussion of variables entering the fee equations in Section III.B. Coefficients for the maturity and credit-rating variables are positive and significant, whereas those for the past issue experience and shelf-registration (MTN) variables are negative and significant.

Investment banks give significantly steeper discounts to MTN issuers than commercial banks do, which suggests that investment banks' greater operational capacity makes it cheaper for them to absorb frequent issues (which MTN issuers typically are). Similarly, coefficients for issue size are negative and statistically significant for both kinds of banks, but the magnitude is economically significant only for investment banks.[22] This result suggests that it is indeed cost-effective for top bulge-bracket investment banks to underwrite large-size issues, while it is not so for smaller entrant commercial banks.[23]

There is a significant fee discount when there are relationships between firms and commercial banks. The negative sign of the relationship coefficient γ^{LOAN} in the fee equation indicates that commercial banks charge lower fees to those firms with which they have had relationships than to other firms.[24] One possible explanation is that their marginal information costs are lower for serving these familiar clients and they are sharing part of the cost savings with them. In particular, it is plausible that entrant commercial banks would set their fees equal to marginal cost while trying to build market share in the underwriting market. On the other hand, given that commercial banks obtain better yields for these firms (as earlier studies found), it is also plausible that commercial banks would charge higher fees in equilibrium to extract away this yield benefit

[21] I also estimated the fee equation underwriter by underwriter and obtained qualitatively equivalent results. The results are not reported here and are available upon request.

[22] For example, by changing the issue size from \$100 million to \$1 billion, the issuer will lower the fees by nearly 10 basis points with an investment bank, but only less than 1 basis point with a commercial bank.

[23] In underwriter-by-underwriter estimation, I find that the coefficients on issue size for smaller investment banks were similar to those of commercial banks; that is, they were either positive or not significantly different from 0. This further confirms the hypothesis that the entrant commercial banks face scale constraints similar to those of the smaller investment banks.

[24] Note that this is not necessarily at odds with the finding in Gande et al. (1999), which reports that commercial banks as a group charged neither a discount nor premium compared to investment banks, since that analysis does not differentiate between commercial banks with relationships and those without.

Table II

Estimation Results of Firm's Underwriter Choice Model

This table reports the estimation results of the baseline model. Panel A presents estimates of the fee equations; Panel B presents estimates of the demand model. The dependent variables in Panel A are the underwriting fees (gross spread) charged by banks in the given issue. The value *ln (MATURITY)* is the natural log of the bond maturity in years. The value *ln (NO. OF ISSUE + 1)* is the natural log of the number of previous bond issues plus 1. The value *MTN* is 1 if the issue is under the Medium-Term Notes Program and 0 otherwise. The value *ln (AMOUNT)* is the natural log of size of the issue in $millions. The variables *Aa* dummy – *Caa* (or below) dummy are credit-rating dummies corresponding to the issue's Moody's ratings. The value $LOAN_{ij}$ is 1 if $bank_j$ ever acted as an arranger in a loan agreement for $firm_i$ during 1980–1992 and 0 otherwise. Year dummies are dummies corresponding to the issue date. SIC dummies refer to dummy variables for primary SIC codes of issuing firms. Point estimates for constant term, year dummies, and SIC dummies are not reported, although they are included in the fee equations. The dependent variable in Panel B is a discrete variable corresponding to the choice of bank. Thus, it is a multinomial variable equaling j if the issuing firm chooses $bank_j$ (j = 1–16) for the lower-nest choice in Figure 1, and a binary variable equaling 1 if the chosen bank is a commercial bank, and 0 otherwise for the upper-nest choice. The value FEE_{ij} is the gross spread charged by $bank_j$ in the given issue. The value $CB\ LOAN_{ij}$ is 1 if $bank_j$ is a commercial bank and $LOAN_{ij} = 1$ and 0 otherwise. The value $IB\ LOAN_{ij}$ is similarly defined. The inclusive value $I_{i,m}$ measures the expected aggregate value of choosing subset m (e.g., commercial banks as a group) for $firm_i$. The value *INVGRADE* is 1 if the issue is rated by Moody's as investment grade and 0 otherwise. Point estimates for year dummies and SIC dummies are not reported, although they are included in the demand estimation.

Panel A: Fee Estimates

Dependent Variable: Underwriting Fees

	Commercial Bank		Investment Bank	
Explanatory Variables	Estimate	Std. err.	Estimate	Std. err.
ln(MATURITY)	0.1953***	(0.0015)	0.1685***	(0.0010)
ln(NO. OF ISSUES + 1)	−0.0510***	(0.0010)	−0.0307***	(0.0006)
MTN dummy	−0.0758***	(0.0043)	−0.1664***	(0.0029)
ln(AMOUNT)	−0.0031**	(0.0014)	−0.0421***	(0.0010)
Aa dummy	0.1357***	(0.0109)	0.1134***	(0.0073)
A dummy	0.1511***	(0.0102)	0.1047***	(0.0069)
Baa dummy	0.1226***	(0.0102)	0.1159***	(0.0069)
Ba dummy	1.0749***	(0.0104)	1.1542***	(0.0070)
B dummy	2.1332***	(0.0103)	2.1458***	(0.0069)
Caa (or below) dummy	2.6007***	(0.0194)	2.5533***	(0.0131)
LOAN	−0.0830***	(0.0040)	0.0904***	(0.0071)
Constant	yes		yes	
Year dummies	yes		yes	
SIC dummies	yes		yes	

(*continued*)

from the firm. The fact that we observe a relationship discount rather than a premium is therefore an interesting finding and suggests that commercial banks are not at an absolute competitive advantage over investment banks in this market.[25]

[25] Song (2004) empirically explores this coexistence issue.

Table II—*Continued*

Panel B: Demand Estimates				
Dependent Variable: Choice of Underwriting Bank				
Explanatory Variables	Estimate	Std. err.	Ho:	p-value
FEE (α)	−0.6441***	(0.0601)	$\beta 1 = \beta 2$	0.6460
CB LOAN ($\beta 1$)	0.7975***	(0.1818)		
IB LOAN ($\beta 2$)	0.9365***	(0.2518)		
Inclusive value	1.0882**	(0.5184)		
In (*MATURITY*)	−0.2039*	(0.1202)		
ln(*NO. OF ISSUES + 1*)	−0.3346***	(0.0765)		
MTN dummy	0.1435	(0.2886)		
ln(*AMOUNT*)	−0.3987***	(0.0910)		
INVGRADE	−0.1083	(0.1861)		
Year dummies	yes			
SIC dummies	yes			

The symbols ***, **, * denote that the coefficient is statistically different from 0 at the 1%, 5%, and 10% significance levels, respectively.
Number of observations: 1,535.

Fang (2005) empirically examines the costs and benefits of hiring a bank with a high reputation and finds that top-tier investment banks indeed obtain better yields and charge higher fees. The better yield could be derived from the investment banks' greater market-making capacity as well as deeper analyst coverage. The paper also finds that issuers that chose low-reputation banks (including the entrant commercial banks) would have been better off choosing the top-tier investment banks, net of the yield and the fees. Building on this finding, the results reported here support the view that commercial banks are at a relative disadvantage vis-à-vis top-tier investment banks overall in terms of their liquidity service and market-making ability, and their relative advantage comes locally, where they have informational advantages due to their bank relationships with the issuers.

For investment banks, in contrast, the effect of relationships on fees is small and significantly positive. Note that these relationships for investment banks are different in nature from those between commercial banks and firms because investment banks acting as arrangers of syndicated loans almost never contribute capital. Rather, they act as pure agents. My interpretation of this premium is that investment banks charge higher fees to extract the yield benefit from their client firms. This explanation is consistent with Fang (2005), which reports that issuing firms with more extensive investment-banking relationships with reputable banks receive a larger yield benefit than those firms without such relationships. Another explanation is that arranger service and underwriter service are implicitly bundled; that is, investment banks arrange loans for a small fee in return for premium underwriting fees.[26]

[26] Note that these loans by construction were arranged prior to 1992, whereas the bond-issue sample period starts in 1993, so the data construction is biased toward rejecting this bundling hypothesis.

Panel B shows that both fee and prior loan relationships are significant determinants of the firm's underwriter choice. The fee coefficient α is negative and significant, indicating a downward-sloping demand for underwriting service. The relationship coefficient β is positive and significant for commercial banks as well as for investment banks. (Wald statistics indicate that the two relationship coefficients are not significantly different from each other; the p-value is reported in the table.) Together with the fee-equation results, these findings imply that while there are fee discounts (in the aggregate) for firms that have had relationships with commercial banks, there is still a net benefit from relationships over and above the fee discount. For investment banks, the implication is slightly different: firms appear to derive a benefit from choosing investment banks with prior arranger relationships, even with the fee premium.

Coefficients on issuer and bond characteristics included in the upper nest are generally as expected and consistent with the summary statistics in Table I. Note that since these are chooser-specific (and not choice-specific) variables, the parameters are estimated separately for each choice. The coefficients for one choice (in this case investment banks) are normalized to 0, so the reported coefficients are for the choice of commercial banks. Coefficients on *ln* (*MATURITY*), *ln* (*NO.ISSUES* + *1*), and *ln* (*AMOUNT*) are all negative and significant. This is consistent with the prediction that firms issuing large bonds and long-maturity bonds are less likely to choose commercial banks (due to their limited operational scale) and that first-time issuers are more likely to choose them than seasoned issuers, potentially due to their prior relationships. The coefficient on *INVGRADE* is not significantly different from 0, which confirms the inference made from Table I. Similarly, the coefficient on *MTN* dummy is not significantly different from 0. This implies that, while banks charge lower fees to MTN issuers (as indicated by the negative coefficients in the fee equations in Panel A), MTN issuers are not (significantly) more or less likely to choose commercial-bank underwriters than non-MTN issuers. The dissimilarity coefficient of the nested logit model λ is 1.0882, which is not significantly different from 1 at the 5% significance level by the Wald test.[27] This finding supports the view that once we control for bank relationships, there are no differences between commercial banks and investment banks that are specific to their organizational forms.

B. Junk vs. Non-junk Model

As discussed in Section I, I am interested in examining how the valuation of relationships varies with informational sensitivity of issuers. Table III reports the estimation results where fee and relationship coefficients are allowed to vary across issuers' credit ratings. Specifically, I estimate separate *LOAN* and *FEE* coefficients for junk-bond issuers and non-junk-bond issuers in the sample. Being in the junk-bond category means issuers have less financial strength

[27] I also estimated a logit model of the baseline model and find that all qualitative results hold. The results are not reported here.

and, in general, face higher informational sensitivity than those in the non-junk-bond category.

Fee-equation estimates in Panel A are qualitatively (and quantitatively) similar to the baseline-model results. Both commercial and investment banks raise fees for larger-maturity issues and lower them for seasoned issuers,

Table III

Estimation Results of Junk vs. Non-junk Model

This table reports the estimation results of the junk vs. non-junk model. Panel A presents estimates of the fee equations; Panel B presents estimates of the demand model. The dependent variables in Panel A are the underwriting fees (gross spread) charged by banks in the given issue. The value *ln* (*MATURITY*) is the natural log of the bond maturity in years. The value *ln* (*NO. OF ISSUE* + *1*) is the natural log of the number of previous bond issues plus 1. The variable *MTN* dummy is 1 if the issue is under the MTN Program and 0 otherwise. The value *ln* (*AMOUNT*) is the natural log of issue size in $millions. The variables *Aa* dummy – *Caa* (or below) dummy are credit-rating dummies corresponding to the issue's Moody's ratings. The variable $LOAN_{ij}$ is 1 if bank_j ever acted as an arranger in a loan agreement for firm_i during 1980–1992 and 0 otherwise. Year dummies are dummies corresponding to the issue date. SIC dummies refer to dummy variables for primary SIC codes of issuing firms. Point estimates for constant term, year dummies, and SIC dummies are not reported, although they are included in the fee equations. The dependent variable in Panel B is a discrete variable corresponding to the choice of bank. Thus, it is a multinomial variable equaling *j* if the issuing firm chooses bank_j (j = 1–16) for the lower-nest choice in Figure 1, and a binary variable equaling 1 if the chosen bank is a commercial bank, and 0 otherwise for the upper-nest choice. The value FEE_{ij} (non-junk issuers) equals the gross spread if firm_i's issue is investment grade, and 0 otherwise. The value FEE_{ij} (junk issuers) is similarly defined. The value $CB\ LOAN_{ij}$ (non-junk issuers) is 1 if firm_i's issue is investment grade, bank_j is a commercial bank and $LOAN_{ij} = 1$, and 0 otherwise. The values $CB\ LOAN_{ij}$ (junk issuers), $IB\ LOAN_{ij}$ (non-junk issuers), and $IB\ LOAN_{ij}$ (junk issuers) are similarly defined. The inclusive value $I_{i,m}$ measures the expected aggregate value of choosing subset *m* (e.g., commercial banks as a group) for firm_i. The value *INVGRADE* is 1 if the issue is rated by Moody's as investment grade and 0 otherwise. Point estimates for year dummies and SIC dummies are not reported, although they are included in the demand estimation.

Panel A: Fee Estimates

Dependent Variable: Underwriting Fees

	Commercial Bank		Investment Bank	
Explanatory Variables	Estimate	Std. err.	Estimate	Std. err.
ln (*MATURITY*)	0.2117***	(0.0015)	0.1681***	(0.0010)
ln (*NO. OF ISSUES* + *1*)	−0.0539***	(0.0010)	−0.0306***	(0.0006)
MTN dummy	−0.0103**	(0.0043)	−0.1666***	(0.0029)
ln (*AMOUNT*)	0.0257***	(0.0014)	−0.0428***	(0.0010)
Aa dummy	0.1084***	(0.0109)	0.1139***	(0.0073)
A dummy	0.1429***	(0.0102)	0.1044***	(0.0069)
Baa dummy	0.0910***	(0.0102)	0.1161***	(0.0069)
Ba dummy	0.9856***	(0.0104)	1.1493***	(0.0070)
B dummy	2.0758***	(0.0103)	2.1398***	(0.0069)
Caa (or below) dummy	2.5643***	(0.0194)	2.5466***	(0.0131)
LOAN	−0.0999***	(0.0040)	0.0893***	(0.0071)
Constant	yes		yes	
Year dummies	yes		yes	
SIC dummies	yes		yes	

(*continued*)

Table III—*Continued*

Panel B: Demand Estimates				
Dependent Variable: Choice of Underwriting Bank				
Explanatory Variables	Estimate	Std. err.	Ho:	p-value
FEE (non-junk issuers) ($\alpha 1$)	−1.7480***	(0.1439)	$\alpha 1 = \alpha 2$	0.0000
FEE (junk issuers) ($\alpha 2$)	−0.4105***	(0.0580)	$\beta 1 = \beta 2$	0.1143
CB LOAN (non-junk issuers) ($\beta 1$)	1.0191***	(0.2300)	$\beta 3 = \beta 4$	0.5083
CB LOAN (junk issuers) ($\beta 2$)	1.6553***	(0.3308)	$\beta 1 = \beta 3$	0.5231
IB LOAN (non-junk issuers) ($\beta 3$)	0.7762**	(0.3123)	$\beta 2 = \beta 4$	0.3001
IB LOAN (junk issuers) ($\beta 4$)	1.1256***	(0.4260)		
Inclusive value	0.9573***	(0.2860)		
ln (*MATURITY*)	−0.1822	(0.1206)		
ln (*NO. OF ISSUES + 1*)	−0.3573***	(0.0777)		
MTN dummy	0.1646	(0.2837)		
ln (*AMOUNT*)	−0.3979***	(0.0864)		
INVGRADE	−0.0715	(0.1862)		
Year dummies	yes			
SIC dummies	yes			

The symbols ***, **, * denote that the coefficient is statistically different from 0 at the 1%, 5%, and 10% significance levels, respectively.
Number of observations: 1,535.

MTN-program users, and higher-credit-rating issues. The investment banks lower fees for large issues, while commercial banks charge a size premium on average. Also as before, there is a relationship discount for commercial banks, while there is a premium for investment banks.

In Panel B, the fee coefficient for non-junk-bond issuers is negative and significant at −1.7480, whereas the fee coefficient for junk-bond issuers is also negative and significant but smaller at −0.4105. The difference is statistically significant. This suggests that demand for underwriting service is much less price-sensitive for junk-bond issuers than for non-junk-bond issuers. The loan coefficients β are positive and significant (either at the 1% or 5% level) for all four subgroups. For commercial banks, the coefficient for junk-bond issuers is significantly larger than that for non-junk-bond issuers. This implies that for junk-bond issuers, relationships with commercial banks are particularly beneficial, over and above the fee discount. The differences in relationship coefficients are not significant for investment banks, though the point estimates vary in the right direction. The difference between *CB LOAN* (junk issuers) and *IB LOAN* (junk issuers) is also not statistically significant. The upper-nest coefficients are qualitatively similar to those in the baseline model. Firms with relatively small issues, short maturity, and little prior-issue experience are more likely to choose commercial-bank underwriters.

C. First-Time vs. Seasoned Model

Table IV reports the estimation results where fee and relationship coefficients in the demand equation are allowed to vary across the newness of the issuers in the corporate-bond market. Investors are less likely to be familiar with or even to recognize the name of first-time issuers in the market, so these firms face greater informational sensitivity than seasoned issuers. Seasoned issuers, on the other hand, have a track record of issuing public debt, which decreases their informational sensitivity.

Table IV

Estimation Results of First-Time vs. Seasoned Model

This table reports the estimation results of the first-time vs. seasoned model. Panel A presents estimates of the fee equations; Panel B presents estimates of the demand model. The dependent variables in Panel A are the underwriting fees (gross spread) charged by banks in the given issue. The value *ln* (*MATURITY*) is the natural log of the bond maturity in years. The value *ln* (*NO. OF ISSUE + 1*) is the natural log of the number of previous bond issues plus 1. The variable *MTN* dummy is 1 if the issue is under the MTN Program and 0 otherwise. The value *ln* (*AMOUNT*) is the natural log of issue size in $millions. The variables *Aa* dummy – *Caa* (or below) dummy are credit-rating dummies corresponding to the issue's Moody's ratings. The variable $LOAN_{ij}$ is 1 if bank_j ever acted as an arranger in a loan agreement for firm_i during 1980–1992 and 0 otherwise. Year dummies are dummies corresponding to the issue date. SIC dummies refer to dummy variables for primary SIC codes of issuing firms. Point estimates for constant term, year dummies and SIC dummies are not reported, although they are included in the fee equations. The dependent variable in Panel B is a discrete variable corresponding to the choice of bank. Thus, it is a multinomial variable equaling j if the issuing firm chooses bank_j ($j = 1$–16) for the lower-nest choice in Figure 1, and a binary variable equaling 1 if the chosen bank is a commercial bank, and 0 otherwise for the upper-nest choice. The value FEE_{ij} (seasoned issuers) equals the gross spread if firm_i is a seasoned issuer, and 0 otherwise. The value FEE_{ij} (first-time issuers) is similarly defined. The value $CB\ LOAN_{ij}$ (seasoned issuers) is 1 if firm_i is a seasoned issuer, bank_j is a commercial bank and $LOAN_{ij} = 1$, and 0 otherwise. The values $CB\ LOAN_{ij}$ (first-time issuers), $IB\ LOAN_{ij}$ (seasoned issuers), and $IB\ LOAN_{ij}$ (first-time issuers) are similarly defined. The inclusive value $I_{i,m}$ measures the expected aggregate value of choosing subset m (e.g., commercial banks as a group) for firm_i. The value *INVGRADE* is 1 if the issue is rated by Moody's as investment grade and 0 otherwise. Point estimates for year dummies and SIC dummies are not reported, although they are included in the demand estimation.

Panel A: Fee Estimates

Dependent Variable: Underwriting Fees

Explanatory Variables	Commercial Bank Estimate	Commercial Bank Std. err.	Investment Bank Estimate	Investment Bank Std. err.
ln (*MATURITY*)	0.2046***	(0.0015)	0.1683***	(0.0010)
ln (*NO. OF ISSUES + 1*)	−0.0511***	(0.0010)	−0.0291***	(0.0006)
MTN dummy	−0.0380***	(0.0043)	−0.1670***	(0.0029)
ln (*AMOUNT*)	0.0118***	(0.0014)	−0.0427***	(0.0010)
Aa dummy	0.1436***	(0.0109)	0.1136***	(0.0073)
A dummy	0.1675***	(0.0102)	0.1039***	(0.0069)
Baa dummy	0.1266***	(0.0102)	0.1159***	(0.0069)
Ba dummy	1.0535***	(0.0104)	1.1555***	(0.0070)
B dummy	2.1326***	(0.0103)	2.1459***	(0.0069)
Caa (or below) dummy	2.6128***	(0.0194)	2.5523***	(0.0131)
LOAN	−0.0921***	(0.0040)	0.0900***	(0.0071)
Constant	yes		yes	
Year dummies	yes		yes	
SIC dummies	yes		yes	

(*continued*)

Table IV—*Continued*

Panel B: Demand Estimates				
Dependent Variable: Choice of Underwriting Bank				
Explanatory Variables	Estimate	Std. err.	Ho:	p-value
FEE (seasoned issuers) ($\alpha 1$)	−1.2563***	(0.1333)	$\alpha 1 = \alpha 2$	0.0000
FEE (first-time issuers) ($\alpha 2$)	−0.4232***	(0.0636)	$\beta 1 = \beta 2$	0.6223
CB LOAN (seasoned issuers) ($\beta 1$)	0.8887***	(0.2489)	$\beta 3 = \beta 4$	0.0255
CB LOAN (first-time issuers) ($\beta 2$)	1.0730***	(0.2794)	$\beta 1 = \beta 3$	0.3482
IB LOAN (seasoned issuers) ($\beta 3$)	0.5117	(0.3236)	$\beta 2 = \beta 4$	0.2047
IB LOAN (first-time issuers) ($\beta 4$)	1.6887***	(0.4159)		
Inclusive value	0.9534**	(0.4116)		
ln (*MATURITY*)	−0.1973	(0.1205)		
ln (*NO. OF ISSUES* + *1*)	−0.3389***	(0.0769)		
MTN dummy	0.1559	(0.2883)		
ln (*AMOUNT*)	−0.3984**	(0.0895)		
INVGRADE	−0.1425	(0.1863)		
Year dummies	yes			
SIC dummies	yes			

The symbols ***, **, * denote that the coefficient is statistically different from 0 at the 1%, 5%, and 10% significance levels, respectively.
Number of observations: 1,535.

Fee-equation coefficients (presented in Panel A) are again similar to the baseline results. In Panel B, the fee coefficient for seasoned issuers is negative at −1.2563, whereas the fee coefficient for first-time issuers is negative at −0.4232. The difference is again statistically significant, suggesting that first-time issuers are much less price-sensitive than seasoned issuers with respect to underwriting services. The loan coefficients β are positive for all four subgroups. The coefficients for first-time issuers are significantly larger than those for seasoned issuers for investment banks. Interestingly, while the *LOAN* coefficients are significant at the 1% level for commercial banks (the differences in coefficients are not significant), for investment banks, they are statistically significant only for first-time issuers. This implies that a benefit of having a relationship with investment banks is significant only for first-time issuers but not for seasoned issuers. The difference between *CB LOAN* (first-time issuers) and *IB LOAN* (first-time issuers) is not statistically significant. Upper-nest coefficients of the demand equation, *ln* (*MATURITY*), *ln* (*NO.ISSUES* + *1*), *MTN*, *ln* (*AMOUNT*), and *INVGRADE* are similar to those reported in the baseline model.

D. The Implied Value of Bank–Firm Relationships

In the demand estimates presented in Panel B of Table II–IV, the trade-offs between relationships and fees imply that issuers are willing to pay a higher fee for underwriting services from banks with preexisting relationships than to

Table V

Implied Values of Relationships

This table tabulates the implied values of bank–firm relationships (measured as ratios of two key coefficients, $|\beta/\alpha|$, and evaluated at the sample mean issue size of $180 million) for the three models presented in Tables II–IV. For the junk vs. non-junk model and first-time vs. seasoned model, these values are computed for each of the four segments of the market, such as *CB LOAN* (nonjunk issuers), *CB LOAN* (junk issuers), *IB LOAN* (nonjunk issuers), and *IB LOAN* (junk issuers) for the junk vs. non-junk model. All coefficients are statistically different from zero at either the 5% or 1% significance level, except the coefficient for *IB LOAN* (seasoned issuers) in the first-time vs. seasoned model. Note that *FEE* is expressed as a percentage of principal and *LOAN* is a dummy variable, so $|\beta/\alpha| = 1$ implies that, at a sample mean issue size of $180 million, the implied value of relationships = 1 ∗ $180 mm/100 = $1.8 mm.

Bank Type	Borrower Reputation of Issuers	$\lvert\beta/\alpha\rvert$	In $millions
	Panel A: Baseline Model		
Commercial banks	All	1.238	$2.23
Investment banks	All	1.454	$2.62
	Panel B: Junk vs. Non-junk Model		
Commercial banks	Non-junk issuers	0.583	$1.05
Commercial banks	Junk issuers	4.032	$7.26
Investment banks	Non-junk issuers	0.444	$0.80
Investment banks	Junk issuers	2.742	$4.94
	Panel C: First-Time vs. Seasoned Model		
Commercial banks	Seasoned issuers	0.707	$1.27
Commercial banks	First-time issuers	2.536	$4.56
Investment banks	Seasoned issuers	N/A[a]	N/A
Investment banks	First-time issuers	3.991	$7.18

[a]The coefficient for *IB LOAN* (seasoned issuers) is not statistically different from 0 at the 10% significance level.

those without.[28] The economic significance of this trade-off is quantified by the absolute value of the ratio of the two coefficients, $|\frac{\beta}{\alpha}|$. Note that *FEE* is expressed as a percentage of principal and *LOAN* is a dummy variable, so $|\frac{\beta}{\alpha}| = 1$ implies that, at a sample mean issue size of about $180 million, the implied value of relationships = 1 ∗ $180 million/100 = $1.8 million. Ratios computed from these tables are reported in Table V.

In the baseline model reported in Table II, this ratio is 1.238 for commercial banks and 1.454 for investment banks. Since the fee is expressed as a percentage and the relationship is a dummy (indicator) variable, this ratio has a unit measure of 1.238% and 1.454%, respectively. This implies that, ceteris paribus, a bank can charge an issuer with which it has a relationship a premium of up to 1.238% (or 1.454%) before the issuer prefers a bank with which

[28] These empirical findings are consistent with the second equilibrium in Puri (1999), where entrant commercial banks are differentiated by the certification ability they possess for a subset of the issuing firms because of their loan relationships with them.

it has no relationship. Evaluated at the sample mean issue size of $180 million, this translates to a premium of about $2.23 million and $2.62 million, respectively. Since the level of the underwriting fee paid by the issuers in the sample ranges anywhere from $200,000 to several million dollars, the value of a relationship implied by the results is quite substantial and, at the same time, reasonable.

In Table III, where this trade-off is allowed to differ between non-junk-bond and junk-bond issuers and also between commercial banks and investment banks, an interesting pattern emerges. For commercial banks, the ratios $|\frac{\beta}{\alpha}|$ are 0.583 and 4.032 for high- and low-reputation issuers, respectively. Using again the mean issue size of $180 million, preexisting relationships for the two classes of issuers are approximately $1.05 million and $7.26 million, respectively. For investment banks, the results are comparable. Consistent with Diamond's reputation-building argument, this large difference in the values of $|\frac{\beta}{\alpha}|$ between junk-bond and non-junk-bond issuers confirms that there is a positive relationship between the informational sensitivity of issuing firms and their valuations of certification by underwriting banks.

Similar implications are obtained from the results reported in Table IV. For commercial banks, the ratios $|\frac{\beta}{\alpha}|$ are 0.707 and 2.536 for seasoned and first-time issuers, respectively. In dollar terms, these are approximately $1.27 million and $4.56 million. For investment banks, the *LOAN* coefficient is not statistically different from 0 for seasoned issuers. For first-time issuers, however, it is significant at the 1% level and the implied value is $7.18 million. Again, these large differences in the values of $|\frac{\beta}{\alpha}|$ between first-time and seasoned issuers show that there is a positive relationship between the informational sensitivity of issuing firms and their valuations of the ability of underwriting banks to certify them as issuers.

E. Bank Reputation

As discussed earlier, this paper mainly focuses on examining the effect of informational sensitivity, or borrower reputation, on the choice of underwriters. As a robustness check, however, I also examine whether the results are sensitive to the inclusion of underwriting-bank-reputation variables. For this purpose, I use two specifications. In one, I include market shares as a proxy for bank reputation. This proxy measure is used in an empirical study by Megginson and Weiss (1991) and is found to be highly correlated with the Carter-Manaster (1990) bank-reputation measure described in Carter, Dark, and Singh (1998). Table VI reports the results. First, the main results are robust to controlling for bank-reputation variables. Both fee and loan coefficients in the demand equation are significant and of the same sign as the baseline model. The other demand estimates and fee-equation estimates are also qualitatively equivalent. The coefficient on market share is negative and significant at −0.9580, suggesting that there is a bank-reputation discount on fees. In addition, I use the binary specification where banks are classified as either high-reputation or low-reputation according to their market share and include these two dummy

Table VI

Bank Reputation

This table presents results of estimations when alternative proxies of bank reputation are included in the fee equations. The point estimates and standard errors of these bank reputation variables in the fee equations are shown in Panel A, and demand estimates are shown in Panel B.

Panel A: Fee Estimates

	Model 1		Model 2	
Alternative Measures of Bank Reputation	Estimate	Std. err.	Estimate	Std. err.
MARKET SHARE (in %)	−0.9580***	(0.0108)		
HI REPUTATION = 1 if bank's market share in top 8			0.4461***	(0.0102)
LOW REPUTATION = 1 if bank's market share NOT in top 8			0.5606***	(0.0102)

Panel B: Demand Estimates

Explanatory Variables	Estimate	Std. err.	Estimate	Std. err.
FEE (α)	−0.6602***	(0.0601)	−0.7063***	(0.0601)
CB LOAN ($\beta 1$)	0.8094***	(0.1820)	0.9299***	(0.1850)
IB LOAN ($\beta 2$)	0.9313***	(0.2518)	0.9137***	(0.2516)
Inclusive value	1.0901**	(0.5035)	1.4829***	(0.4354)
ln (MATURITY)	−0.2031*	(0.1202)	−0.2036*	(0.1197)
ln (NO. OF ISSUES + 1)	−0.3371***	(0.0767)	−0.3296***	(0.0761)
MTN dummy	0.1375	(0.2872)	0.1742	(0.2857)
ln (AMOUNT)	−0.3952***	(0.0911)	−0.3833***	(0.0905)
INVGRADE	−0.1000	(0.1862)	−0.1612	(0.1876)
Year dummies	yes		yes	
SIC dummies	yes		yes	

The symbols ***, **, * denote that the coefficient is statistically different from 0 at the 1%, 5%, and 10% significance levels, respectively.
Number of observations: 1,535.

variables in the fee equation. I find that the results are qualitatively unchanged with this second specification; that is, the coefficient is larger (and positive) for the less reputable banks.

These results are consistent with the empirical findings of Livingston and Miller (2000) and James (1992). However, the results are at odds with theoretical predictions of Chemmanur and Fulghieri (1994a) and Booth and Smith (1986). One possible explanation for the finding reported here and the general discrepancy between the theoretical prediction and existing empirical evidence is that there is endogenous quality sorting between firms and banks.

F. Does the Strength of Relationships Matter?

As discussed in Section III.A, I use arrangership of loan agreements as an indicator of a prior banking relationship. In Table VII, I report the results of broadening this relationship definition along two dimensions.

Table VII

Results with Alternative Measures of Relationships

This table presents estimation results of the baseline model when alternative measures of bank–firm relationships are used. In addition to the baseline definition of relationships, three alternative measures of relationships are constructed based on the six bank roles identifiable in the Loanware database: (1) arranger, (2) lead-manager, (3) co-lead manager, (4) co-manager, (5) co-agent, and (6) participant. Alternative measures of relationships used are (A) $LOAN_j = 1$ if Bank$_j$ played any of the roles (1)–(5); (B) number of transactions in which Bank$_j$ played any of the roles (1)–(5); and (C) $LOAN_j = 1$ if Bank$_j$ played any of the roles (1)–(6). Demand estimates are presented.

	Panel A: Roles (1)–(5)		Panel B: No. of Deals (Roles (1)–(5))		Panel C: Roles (1)–(6)	
Explanatory Variables	Estimate	Std. err.	Estimate	Std. err.	Estimate	Std. err.
FEE (α)	−0.6042***	(0.0601)	−0.6264***	(0.0607)	−0.5576***	(0.0599)
CB LOAN ($\beta 1$)	0.2646*	(0.1576)	0.1500***	(0.0424)	−0.1214	(0.1449)
IB LOAN ($\beta 2$)	2.4345***	(0.2159)	1.8969***	(0.2210)	2.0939***	(0.1790)
Inclusive value	0.4111	(0.4473)	0.5386	(0.6257)	0.1090	(0.4885)
ln (*MATURITY*)	−0.2204*	(0.1209)	−0.2151*	(0.1225)	−0.2350*	(0.1214)
ln (*NO. OF ISSUES + 1*)	−0.3149***	(0.0758)	−0.3159***	(0.0758)	−0.3141***	(0.0758)
MTN dummy	0.0413	(0.2859)	0.0632	(0.2945)	−0.0022	(0.2890)
ln (*AMOUNT*)	−0.4355***	(0.0908)	−0.4257***	(0.0965)	−0.4568***	(0.0927)
INVGRADE	−0.1086	(0.1863)	−0.1013	(0.1870)	−0.1145	(0.1860)
Year dummies	yes		yes		yes	
SIC dummies	yes		yes		yes	

The symbols ***, **, * denote that the coefficient is statistically different from 0 at the 1%, 5%, and 10% significance levels, respectively.
Number of observations: 1,535.

First, I use both dummy variables, as measures of the presence or absence of relationships, and count variables (i.e., the number of transactions that have occurred in the past), as measures of both the existence and intensity of relationships. Second, I incorporate information on what roles a bank played in a given transaction. In this way, I construct the most exclusive measures using only the top-position role (i.e., arranger); the most inclusive measures, using the union of all six roles reported (i.e., arranger, lead-manager, co-lead manager, co-manager, co-agent, and participant); and medium measures that fall between the previous two.

When I use the arranger definition, the results are robust to whether I use dummy or count variables. When I broaden the definition of relationships to include other bank roles reported for loans, an interesting finding emerges: Participant is not a meaningful measure of relationships. When I include the remaining four roles in the definition of relationships, the results are qualitatively the same. The results are reported in Panels A and B of Table VII. The relationship coefficient for commercial banks is positive and significant but smaller than is obtained when using the "only-arranger" definition. This finding is consistent with the prediction that the closer to the top of the syndicate the bank is, the more significant its relationship is, and therefore the more significant informational advantage such a bank gains. The relationship coefficient for investment banks, on the other hand, remains large. This is because investment banks rarely serve in any role other than arranger in the syndicated loan market. Thus, inclusion of more minor bank roles dilutes relationship variables for commercial banks but not for investment banks.

When I include participant (the lowest position in the syndicate) in the definition, though, I find that the *LOAN* coefficient for commercial banks is not significantly different from 0. The results are reported in Panel C. I think this is because when banks serve as participants, they are merely invited to participate in the deal by the arranger or lead-manager bank. These participant banks probably do not have any direct interactions with the borrower firms and thus do not gain any superior information about them. In contrast, banks gain superior information (or certification ability) when they serve as one of the leading lenders to the firms.[29]

V. Conclusion

This paper empirically examines the effect of bank relationships on the firm's underwriter choice in the U.S. corporate-bond underwriting market following the entry of commercial banks in 1989. Using a framework that allows imputation of unobserved fees conditional on the choice of underwriter, I directly model the firm's underwriter-choice problem and measure the effect of relationships on the choice of underwriter, both when the banks are chosen and when they are not.

I find that bank relationships are significant in determining a firm's underwriter choice: Firms are more likely to choose banks with relationships than those without. This result is sharply stronger for junk-bond and first-time issuers. Underwriting fees, on the other hand, are also found to affect underwriter choice significantly: Higher fees reduce the likelihood of being chosen as an underwriter. Furthermore, demand for underwriting services is much less fee-sensitive for junk-bond and first-time issuers than for non-junk-bond and seasoned issuers. Consistent with Diamond's reputation-building argument, these results show that the issuing firm's informational sensitivity is positively related to its valuation of certification by underwriting banks.

The first finding indicates that firms derive a benefit from choosing banks with which they have had relationships, over and above their effects on fees. What is the effect of relationships on fees themselves? I find that there is a substantial fee discount when there are relationships between the firms and commercial banks. One possible explanation is that their marginal information costs are lower for serving their preexisting clients and they are sharing part of the cost savings with them. In particular, it is plausible that entrant commercial banks would set their fees equal to their marginal cost in order

[29] This result that not all relationships are equal is also confirmed in Yasuda (2004), where I conduct a similar analysis using the Japanese bank data.

to build market share in the underwriting market. The fact that we observe a relationship discount rather than a premium suggests that commercial banks are not at an absolute competitive advantage over investment banks in this market. In contrast, I find that there is a premium on fees when there are arranger relationships between firms and investment banks. This suggests that investment banks extract at least part of the yield benefit from their old client firms by charging them higher fees.

Finally, I find that the strength of the bank relationship with the firm matters. Specifically, merely serving as a participant in the past loan transaction does not affect a bank's chance of being chosen as underwriter in the future. In contrast, serving as the arranger of a past loan transaction has the strongest effect on a bank's likelihood of being chosen as underwriter. In terms of the economic roles of loan syndicates, this finding suggests that when banks serve as participants, they are merely invited to participate in the deal by the arranger or lead-manager bank for risk-sharing purposes. These participant banks are not likely to have any direct interactions with the borrower firms and thus do not gain any superior information about them. In contrast, banks gain superior information (or certification ability) when they serve as one of the leading lenders to the firms and this information does not appear to be passed on to lower-tier syndicate members.

Together, the evidence presented in this paper shows that bank relationships are very important in shaping bank competition in the bond underwriting market. Firms derive a benefit from choosing a bank with prior bank relationships, over and above their effects on fees. This explains the successful entry by commercial banks into this market, since they had preexisting relationships with many of the issuing firms in the loan market. However, this benefit is not uniformly distributed among the firms. Rather, it is positively related to the severity of information asymmetries that firms have to overcome vis-à-vis investors. Thus, those who stand to gain the most from the certification benefit of bank relationships are junk-bond investors and first-time issuers. Moreover, not all relationships are beneficial: Firms only value those relationships where banks played a pivotal informational role.

Appendix

In the EM algorithm framework, the observed data are viewed as being "incomplete" and are augmented by unobserved data to make up the "complete data." Each EM iteration involves an E-step, where the conditional expectation of the complete-data log likelihood given the observed data is computed using the previous estimates $\theta_{(0)}$ and an M-step, where the conditional expectation is maximized over θ. This procedure is repeated iteratively until convergence is achieved.

- Let c_i represent the index of the bank chosen by firm i.
- Let $\theta = \{\alpha, \beta, \gamma, \sigma\}$.
- Let z represent the explanatory variables entering the fee equations.

- Let $p_{i,j}$ represent the underwriting fees, and let $x_{i,j}$ represent the relationship variables.

We observe c_i and p_{i,c_i}, as well as $x_{i,j}, z_i$. The task is to estimate θ according to the maximum likelihood principle. I do this using an EM-type algorithm, assuming p_{-c_i} to be the "hidden" data and hence $\{c_i, p_{c_i}, p_{-c_i}\}$ to be the complete data. Thus, I need to establish $\Pr(c_i, p_{c_i}, p_{-c_i} \mid \theta)$.

$$\Pr(c, p_c, p_{-c} \mid \theta) = \Pr(c \mid p_c, p_{-c}, \theta) \Pr(p_c, p_{-c} \mid \theta) \tag{A1}$$

by Bayes' rule. According to the logit demand model,

$$\Pr(c \mid p_c, p_{-c}, \theta) = \frac{e^{\alpha p_c + \beta x_c}}{\sum_{k=1}^{K} e^{\alpha p_k + \beta x_k}}. \tag{A2}$$

According to the i.i.d. normal distribution of u_k, we know that each $p_k \sim N(z^T \gamma_k, \sigma^2)$ independently. Hence,

$$\Pr(p_c, p_{-c} \mid \theta) = \prod_{k=1}^{K} \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{1}{2\sigma^2}(p_k - z^T\gamma_k)^2}. \tag{A3}$$

Hence, we have the log likelihood of the complete data (of a single firm) as

$$\begin{aligned} \ln \Pr(c, p_c, p_{-c} \mid \theta) = &-\frac{1}{2\sigma^2} \sum_{k=1}^{K} \left(p_k - z^T \gamma_k\right)^2 - \frac{K}{2} \ln 2\pi\sigma^2 \\ &+ \ln \frac{e^{\alpha p_c + \beta x_c}}{\sum_{k=1}^{K} e^{\alpha p_k + \beta x_k}}. \end{aligned} \tag{A4}$$

In order to implement the E-step, I compute

$$\begin{aligned} &E_{\theta^{(0)}}(\ln \Pr(c, p_c, p_{-c} \mid \theta) \mid c, p_c) \\ &= \int \ln(\Pr(c, p_c, p_{-c} \mid \theta)) \Pr\left(p_{-c} \mid c, p_c, \theta^{(0)}\right) dp_{-c} \\ &= \left(\int \frac{\prod_{k \neq c} e^{-\frac{1}{2\sigma^{2,(0)}}(p_k - z^T \gamma_k^{(0)})^2}}{e^{\alpha^{(0)} p_c + \beta^{(0)} x_c} + \sum_{k \neq c} e^{\alpha^{(0)} p_k + \beta^{(0)} x_k}} dp_{-c} \right)^{-1} \\ &\quad \times \int \ln(\Pr(c, p_c, p_{-c} \mid \theta)) \left(\frac{\prod_{k \neq c} e^{-\frac{1}{2\sigma^{2,(0)}}(p_k - z^T \gamma_k^{(0)})^2}}{e^{\alpha^{(0)} p_c + \beta^{(0)} x_c} + \sum_{k \neq c} e^{\alpha^{(0)} p_k + \beta^{(0)} x_k}} \right) dp_{-c}. \end{aligned} \tag{A5}$$

Note that the first integral term is irrelevant in the M-step because it is a function only of the old parameters $\theta^{(0)}$ and therefore is invariant with respect to new θ. So for the rest of this section I drop this term from the analysis. What remains inside the second integral term is the product of a log of complete-data likelihood (evaluated at the new θ) and the remaining part of the conditional probability $\Pr(p_{-c} \mid c, p_c, \theta^{(0)})$, to be evaluated at the old θ.

These are high-dimensional ($K = 16$) integrals over hybrid distributions consisting of normal and logit components and are computationally nontrivial. Neither numerical integration nor Monte-Carlo EM (where the E-step is replaced by a Monte-Carlo process) is trivial nor immediately promising given the high dimensionality. Instead, I use what is commonly referred to as an "EM-type algorithm," where the single most likely value p_{-c} that maximizes the conditional density above (i.e., only $\Pr(c, p_c, p_{-c} \mid \theta^{(0)})$) is computed and a probability of 1 is placed on these data. In terms of the underlying economic problem, this part can be described as adjusted fee imputation, where, instead of using unconditionally imputed fees for unobserved fees, I replace them with fees that are adjusted to maximize the joint likelihood $\Pr(c_i, p_c, p_{-c})$, using estimates of θ from the previous iteration.

To monitor convergence, we need to evaluate the observed-data likelihood function $L(\theta^{(k)})$ in each (k^{th}) iteration. In my model, the incomplete-data likelihood function is expressed as

$$\begin{aligned}\Pr(c, p_c \mid \theta) &= \int \Pr(c, p_c, p_{-c} \mid \theta)\, dp_{-c} \\ &= \int \prod_{k=1}^{K} \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{1}{2\sigma^2}(p_k - z^T\gamma_k)^2} \left(\frac{e^{\alpha p_c + \beta x_c}}{\sum_{k=1}^{K} e^{\alpha p_k + \beta x_k}} \right) dp_{-c}. \qquad \text{(A6)}\end{aligned}$$

As discussed above, these integrals are computationally challenging. Laplace's method provides a useful way of approximating integrals that take the form

$$I(\lambda) = \int_D e^{-\lambda g(x)} f(x)\, dx, \qquad \text{(A7)}$$

where λ is a large parameter.[30] I apply this approximation method to evaluate the observed-data likelihood function.

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